

## Storage Assignment Strategies to Reduce Manual Picking Errors with an Emphasis on an Ageing Workforce

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**Abstract :** Order picking, i.e., the order-based retrieval of items in a warehouse, is an important time- and cost-intensive process for many logistic systems. Despite the ongoing trend of automation, most order picking systems are still manual picker-to-parts systems, where human pickers walk through the warehouse to collect ordered items. Human work in warehouses is not free from errors, and order pickers may at times pick the wrong or the incorrect number of items. Errors can cause additional costs and significant correction efforts. Moreover, age might increase a person's likelihood to make mistakes. Hence, the negative impact of picking errors might increase for an aging workforce currently witnessed in many regions globally. A significant amount of research has focused on making order picking systems more efficient. Among other factors, storage assignment, i.e., the assignment of items to storage locations (e.g., shelves) within the warehouse, has been subject to optimization. Usually, the objective is to assign items to storage locations such that order picking times are minimized. Surprisingly, there is a lack of research concerned with picking errors and respective prevention approaches. This paper hypothesize that the storage assignment of items can affect the probability of pick errors. For example, storing similar-looking items apart from one other might reduce confusion. Moreover, storing items that are hard to count or require a lot of counting at easy-to-access and easy-to-comprehend self heights might reduce the probability to pick the wrong number of items. Based on this hypothesis, the paper discusses how to incorporate error-prevention measures into mathematical models for storage assignment optimization. Various approaches with respective benefits and shortcomings are presented and mathematically modeled. To investigate the newly developed models further, they are compared to conventional storage assignment strategies in a computational study. The study specifically investigates how the importance of error prevention increases with pickers being more prone to errors due to age, for example. The results suggest that considering error-prevention measures for storage assignment can reduce error probabilities with only minor decreases in picking efficiency. The results might be especially relevant for an aging workforce.

**Keywords :** an aging workforce, error prevention, order picking, storage assignment

**Conference Title :** ICGSCLM 2022 : International Conference on Global Supply Chain and Logistics Management

**Conference Location :** Toronto, Canada

**Conference Dates :** July 19-20, 2022